CLAIM + DETAILED DESCRIPTION

[Claim(s)]
[Claim 1] The sample supporting structure characterized by having two or more press equipment which becomes independent about the thrust and pinches two or more parts of said sample individually to said stage possible [regulation] in the sample supporting structure holding the planate sample laid in the stage movable to one way at least, respectively.
[Claim 2] It is the sample supporting structure characterized by equipping said stage with the vacuum absorption equipment which carries out vacuum absorption of said sample collectively in the sample supporting structure of Claim 1.
[Claim 3] It is the sample supporting structure characterized by being prepared in the clamping circuit supported to revolve possible [rotation] in order that each of said press equipment may pinch said sample between said stages in the sample supporting structure of Claim 1, and coinciding the rotation axial center of said clamping circuit with the surface height of said sample mostly.
[Claim 4] The reticle stage which carries out fixed maintenance of the reticle in which the pattern was formed with Claim 1 - one sample supporting structure of three, It has a substrate stage holding the induction board which exposes said pattern, and the projection optics which projects the illumination light which penetrated said reticle on said induction board. The scanning photolithography machine characterized by projecting said pattern on said induction board, moving synchronously in said reticle stage and a substrate stage.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the sample supporting structure which can hold on a stage the sensitization board with which projection exposure of the reticle and mask with

which the semiconductor circuit pattern, the liquid crystal element pattern, etc. were formed, or such a pattern is carried out. Moreover, this invention relates to the scanning photolithography machine which synchronizes and moves a reticle, a mask, and an induction board on both sides of projection optics.

[0002]

[Description of the Prior Art] for example, [the scanning projection aligner which moves a reticle stage and a wafer stage to an opposite direction by the velocity ratio according to projection reduction percentage at **, respectively, and carries out projection exposure of the reticle pattern to a wafer] The reticle in which various kinds of patterns were formed is carried by vacuum absorption on a reticle stage, and a wafer and a glass substrate are also carried by vacuum absorption on a substrate stage. For example, a reticle is laid on the vacuum pad prepared in the reticle stage, the air of the upper part of a vacuum pad is attracted and a reticle stage is adsorbed by the compressor in a reticle.

[0003]

[Problem to be solved by the invention] However, in order to raise throughput, when stage drift speed is accelerated, in holding a reticle by vacuum absorption, there is a possibility that a reticle may shift from a regular position in the inertial force of a reticle stage. In order to secure adsorption power, extending the area of vacuum absorption is also considered, but it is difficult to acquire only the adsorption power which room to extend area does not not much have and prevents the gap by inertial force. And if it shifts even when reticles are few, the alignment accuracy of a reticle will fall remarkably.

[0004] This invention aims at offering the scanning photolithography machine equipped with the sample supporting structure which carries out fixed maintenance of the sample so that the surface of a sample may not be distorted, and its sample supporting structure while a sample gap makes it hard to occur by the inertial force at the time of the decrease of acceleration of a stage.

[0005]

[Means for solving problem] It matches with drawing 1 of the form of 1 operation - 4, and this invention is explained. (1) Invention of Claim 1 is applied to the sample supporting structure 60 holding the planate sample 3 laid in the stage 4 movable to one way at least. And the above-mentioned purpose is attained by having two or more press equipment 70a-70c which becomes independent about the thrust and pinches two or more parts of a sample 3 individually to a stage 4 possible [regulation], respectively.

(2) It is desirable to have collectively vacuum absorption equipment which carries out vacuum absorption of the sample 3 like invention of Claim 2.

(3) [the sample supporting structure 60 by invention of Claim 3] Press equipment 70a-70c is formed in the clamping circuit 63 supported to revolve possible [rotation], a sample 3 is

pinched between a stage 4 and press equipment 70a-70c through a clamping circuit 63, and the rotation axial center 62 of a clamping circuit 63 is mostly coincided with the surface height of a sample 3 in this case.
(4) The reticle stage 4 where invention of Claim 4 carries out fixed maintenance of the reticle 3 in which the pattern was formed with Claim 1 - one sample supporting structure 60 of three, It is the scanning photolithography machine which projects a pattern on the induction board 10, moving [have the substrate stage 13 holding the induction board 10 which exposes a pattern, and the projection optics 9 which projects the illumination light which penetrated the reticle 3 on the induction board 10, and] synchronously in the reticle stage 4 and the substrate stage 13.
[0006] Although it matched with the form of operation and this invention was explained in the column of a means to solve the above technical problem, thereby, this invention is not limited to the form of operation.
[0007]
[Mode for carrying out the invention] The scanning photolithography machine equipped with the sample supporting structure with which this invention was applied by drawing 1 - drawing 4 is explained.
[0008] In drawing 1 , the illumination light for exposure from the pulse oscillation [, such as excimer laser] type light source 1 illuminates a reticle 3 as pulse exposing light IL of uniform illumination distribution through the illumination-light study system 2. The illumination-light study system 2 consists of a beam shaping optical system, a dimming optical system, optical integrator, a field stop, a condensing lens, etc. The semiconductor circuit pattern and the liquid crystal element pattern are formed in the reticle 3, and the transmitted light which penetrated the pattern is projected by the projection optics 9 on a wafer 10. Photoresist is applied to the surface of a wafer 10, the projected pattern image is exposed on a resist and a latent image is formed.
[0009] Fixed maintenance is carried out with the sample supporting structure 60 later mentioned on the reticle stage 4 through the reticle holders 30 and 32 mentioned later, and a reticle 3 moves in the XY direction in a field perpendicular to the optical axis of the projection optics 9 on the reticle stage 4. A reticle 3 is moved in the direction of X, and the direction of -X when exposing, and exposing light IL is scanned. The move mirror 6 is fixed on the reticle stage 4, the laser beam from the laser interferometer 7 is irradiated by the move mirror 6, an interferometer 7 receives the reflective beam, and the direction position coordinate of X of the reticle stage 4 is measured. This direction position coordinate of X is inputted into the main control system 8 which superintends the whole projection aligner as a signal S1. Although illustration has not been carried out, the move mirror and laser interferometer for measuring the direction position coordinate of Y of the reticle stage 4 are also formed, and this direction

position coordinate of Y is also inputted into the main control system 8. The main control system 8 controls a source of a stage drive like a linear motor by the reticle stage control instruments 4a, and controls the position and drift speed of a reticle 3.

[0010] Here, the sample supporting structure 60 which fixes a reticle 3 on the reticle stage 4 is explained in detail based on drawing 2 - drawing 4 .

[0011] In drawing 2 (a) which looked at the reticle stage 4 from the upper part, and drawing 2 (b) which is the front view, opposite arrangement of the reticle holders 30 and 32 is carried out on the reticle stage 4. The reticle holders 30 and 32 shall be formed by SERAMMIKKUSU, and the flatness shall be 0.4 micrometer or less. In addition, the flatness of a reticle 3 is usually 1-2 micrometers. Along with the longitudinal direction, the apertures 30a and 32a for vacuum wafer adsorption are formed in the reticle holders 30 and 32, and vacuum absorption of the reticle 3 is carried out on the reticle holder 30 and 32. Furthermore, pinching immobilization of the reticle 3 is carried out among the reticle holders 30 and 32 by the sample supporting structure 60.

[0012] The sample supporting structure 60 is explained. In addition, although the sample supporting structure 60 is formed in right and left, respectively, the composition is the same and explains the right-hand side sample supporting structure 60. A predetermined interval is opened in the outside of the direction of X of the reticle holders 30 and 32, the bracket 61 of a pair is installed, the arm 64 of a clamping circuit 63 is rotatably supported to revolve by the bracket 61 of this pair with an axis 62, and, thereby, a clamping circuit 63 is rotatably held to a bracket 61. He is trying for the height position of the axial center of an axis 62 to be mostly in agreement with the height of the surface of a reticle 3. The Reason is mentioned later.

[0013] in the central part of the clamping circuit 63, the drive arm 65 drives attachment and this drive arm 65 by the motor 66 with a gear head installed on the reticle stage 4. The cam board 67 is formed in the output axis 66a of a motor 66, and the cam follower 68 is rotatably formed in it at the end of the cam board 67 as well shown in drawing 3 . When this cam follower 68 contacts the undersurface of an arm 65 and rocks the cam board 67 in the direction of a counterclockwise rotation by a motor 66, a clamping circuit 63 rocks in the direction of a counterclockwise rotation by making an axis 62 into the center of rotation. It is given to the arm 65 with the spring whose energization power of the direction of a clockwise rotation is not illustrated for a clamping circuit 63. Therefore, if the cam board 67 is rocked in the direction of a clockwise rotation by a motor 66, a clamping circuit 63 will be rocked in the direction of a clockwise rotation according to spring power, and will serve as a reticle injection posture as shown in drawing 3 according to a two-dot chain line.

[0014] Press equipment 70a, 70b, and 70c is formed in the clamping circuit 63 at intervals of predetermined as shown in drawing 2 (a). All are the same composition and drawing 4 which shows the IV-IV line section of drawing 1 explains them. The cross-shaped press implement

71 was accommodated in the cylindrical hole 63a currently formed in the clamping circuit 63, and the tip part is projected by the spring power of the spring 72 from the undersurface of the clamping circuit 63. The upper part of Hole 63a is closed by the screw cap 73, adjusts the screwing position of a screw cap 73, adjusts spring power with a spring 72, and, thereby, adjusts the reticle thrust by the press implement 71. The sample supporting structure 60 will be arranged in right and left of a reticle 3, respectively, and will fix three both sides of a reticle 3 at a time, respectively. At this time, the thrust of each press implement 71 is individually adjusted with a spring 72. In addition, according to the drift speed (or acceleration) of the reticle stage 4, you may decide the reticle thrust by the press implement 71. For example, what is necessary is to enlarge reticle thrust, when the drift speed (or acceleration) of the reticle stage 4 is large, and just to make reticle thrust small, when drift speed (or acceleration) is small. Moreover, it is desirable to use the light quality of the materials, such as an aluminium and a plastic, as the quality of the material of the press implement 71.
[0015] Furthermore, the limit switch which is closed when each spring 72 bends, respectively in more than the specified quantity and which is not illustrated is prepared in each press equipment 70a-70c, respectively. And if the whole of each limit switch closes, the control circuit which is not illustrated [which suspends rotation of a motor 66] is prepared.
[0016] In drawing 1 , the reticle blind 5 which the rectangular aperture 5a was able to open is arranged in the undersurface of the reticle stage 4. A rectangle slit-like illuminated field is substantially set up on a reticle 3 by the aperture 5a of this reticle blind 5.
[0017] The pattern image of the illuminated field restricted by the aperture 5a of the reticle blind 5 among the patterns drawn on the reticle 3 is projected on a wafer 10 through the projection optics 9 arranged under the reticle blind 5. That is, a conjugate field turns into an exposure region of the rectangle on a wafer 10 about the illuminated field and the projection optics 9 on the reticle 3 restricted by the aperture 5a of the reticle blind 5.
[0018] A wafer 10 is held on Z leveling stage 12 through the wafer holder which is not illustrated. Z leveling stage 12 is laid on the XY stage 13 through the actuator which can move to three Z directions freely. Displacement of each actuator is measured by the accompanying encoder, respectively. The method which drives a cam by a rotary motor and carries out rectilinear movement to a Z direction, the method which expands and contracts a laminated type piezoelectric element and carries out rectilinear movement to a Z direction, etc. are used for an actuator. As for an encoder, an optical type and an electrostatic capacity type are used. The Z direction displacement signal of the above-mentioned encoder for leveling is inputted into the position sensing device 17, and computes the Z direction position of a wafer 10, the slope angle of the circumference of the X-axis, and the slope angle of the circumference of the Y-axis from the measurement value of the Z direction of three fulcrums. The main control system 8 controls the actuator for Z leveling by the wafer stage drive circuit 16, and controls

the Z direction position and slope angle of a wafer 10. If an equivalent amount of three actuators for Z leveling are displaced, the position of a Z direction can be adjusted, and if you make it displaced individually, the slope angle of the circumference of the X-axis of Z leveling stage 12 and the circumference of the Y-axis can be adjusted.

[0019] The XY stage 13 consists of an X stage which scans a wafer 10 in the direction of X, and a Y stage scanned in the direction of Y. An X stage and Y stage are prepared on a base so that it may be held at an air bearing, for example, may move to XY both directions with a linear motor.

[0020] On Z leveling stage 12, the move mirror 14 for the X-axes and the move mirror for the Y-axes (un-illustrating) are fixed. The laser beam from the laser interferometer 15 currently fixed to the base is irradiated by the move mirror 14, an interferometer 15 receives the reflective beam, and the direction position of X of Z leveling stage 12 is measured. The direction of Y is measured similarly. The direction of X and the direction position coordinate of Y are also inputted into the main control system 8. The main control system 8 controls a source of a stage drive like a linear motor, carries out drive control of the XY stage 13, and controls the position and drift speed of a wafer 10 by the wafer stage drive circuit 16.

[0021] For example, when the projection optics 9 projects an inverted image with the projecting magnification beta (for example, 1/4), it synchronizes with scanning a reticle 3 at speed VR in the direction of +X, or the direction of -X to an illuminated field through the reticle stage 4. A wafer 10 is scanned at speed VW in the direction of -X, or the direction of +X through an X stage. Here, the wafer speed VW is expressed with -(1/beta) VR.

[0022] Moreover, the drift speed of the reticle stage 4 at the time of slit scan exposure and the wafer side XY stage 13 is determined by the sensitivity of the photoresist applied to Aperture 5a and the wafer 10 of the quantity-of-light reticle blind 5 of the pattern exposing light IL which are irradiated on a reticle 3 etc. That is, stage speed is controlled so that the photoresist on a wafer 10 exposes enough by movement of the reticle stage 4 to within a time [in which the pattern on a reticle 3 crosses the aperture 5a of the reticle blind 5].

[0023] In drawing 1 , the multipoint focus sensing devices 19 and 20 are arranged in the both sides of the direction of X of the projection optics 9. The multipoint focus sensing devices 19 and 20 measure the height of the surface of a wafer 10, and the focal signal S2 is supplied to the arithmetic unit 18. As opposed to the exposure region exposed in a next exposure region based on the focal signal S2 with which the arithmetic unit 18 was read previously the height which should be set up on Z leveling stage 12 -- inclining (target height and target inclination) -- it asks and the information on these target height and target inclination is supplied to the main control system 8. The main control system 8 controls operation of Z leveling stage 12 through the stage control instruments 16 based on this information.

[0024] In such a photolithography machine, fixed maintenance of the reticle 3 is mechanically

carried out on the reticle stage 4 with the sample supporting structure 60 shown in drawing 2 prepared on the reticle stage 4 - drawing 4 . Therefore, the following operation effects can be acquired.
(1) By mechanical fixed maintenance, even if a scanning speed of the reticle stage 4 accelerates, it can prevent certainly that a position shifts according to inertial force compared with a vacuum absorption method like before at the time of acceleration and deceleration. For this reason, since drift speed of the reticle stage 4 and an X stage can be enlarged, exposure time can be shortened and the throughput of a scanning photolithography machine can be improved.
(2) Since he is trying for the same vacuum absorption as usual to also fix a reticle 3 in addition to the mechanical fixed maintenance by a clamping circuit 63, reticle holding power can be enlarged more. In this case, if a reticle 3 is laid in the reticle holders 30 and 32 by a loader, a reticle 3 is first fixed by vacuum absorption, and a reticle 3 is fixed to after an appropriate time by a clamping circuit 63. Thereby, when the press implement 71 contacts a reticle 3, it can prevent that a reticle 3 shifts. Namely, since rough alignment of the position of a reticle 3 is carried out when a reticle 3 is laid on the reticle holder 30 and 32 by a loader When it fixes by a clamping circuit 63 and the position shifts from the tolerance level of rough alignment, it is necessary to perform rough alignment again. Before fixing a reticle 3 mechanically like the form of this operation, by fixing by vacuum absorption beforehand, a position gap is prevented and the rerun of rough alignment is prevented. In addition, you may carry out maintenance immobilization only by a clamping circuit 63, without carrying out vacuum absorption.
[0025] (3) [the center of rotation of a clamping circuit 63] since it was made mostly in agreement with the surface height of a reticle 3 A possibility that the tip of the press implement 71 may hit at right angles to a reticle 3, and may not be slippery, positioning accuracy may improve when pressing the surface of a reticle 3 by a clamping circuit 63, and garbage may be generated by friction also decreases.
[0026] (4) The sample supporting structure 60 has three pieces of press equipment 70a-70c, as shown in drawing 2 - 4, respectively. Each press implement 71 can prevent per Kata like [in the case of pressing one neighborhood of a reticle with one press implement like before, and fixing], even when the thrust can be adjusted independently with a spring 72, respectively, therefore a reticle 3 has a wave and unevenness. As a result, a reticle 3 comes to imitate the plane of the reticle holders 30 and 32 with more sufficient flatness, and becomes better [the flatness of the reticle 3 in the state where it was held] than the flatness in the state where it is not held. Moreover, there is no possibility that load [**** / un-] may act on a reticle 3, and there is also no distorted development by it. Since he is trying to stop the drive of a motor 66 further again if each spring 72 bends in more than the specified quantity, if the spring modulus of the spring 72 is made small, the thrust by each press equipment 70a-70c can be controlled almost

uniformly.

[0027] Although it was made to carry out fixed maintenance of the reticle 3 with six pieces of press equipment above, you may carry out fixed maintenance with seven or more pieces of press equipment. Although the clamping circuit 63 was made to rock by a motor 66, you may drive by other actuators, such as an air cylinder, it may replace with a cam, and movement of an actuator may be changed into rocking movement of a clamping circuit by a link etc. Or an axis 62 may be rotated by a motor and a clamping circuit 63 may be rocked.

[0028] Moreover, above, although the supporting structure of the reticle 3 was explained, when the drift speed of a wafer accelerates further, this invention can be applied also to the equipment which carries out fixed maintenance of the wafer on Z leveling stage. Furthermore, although the projection aligner using excimer laser was explained The projection aligner with which this invention used x line irradiates charged particle beams, such as an electron beam, from the first at the stencil mask with which the pattern was formed, and can be applied also to the charged particle beam projection aligner which carries out projection exposure of the pattern to an induction board by the electromagnetic lens, a deflecting system, etc.

[0029]

[Effect of the Invention] Since the press equipment which can adjust thrust independently and presses two or more parts on a sample individually was formed according to this invention when carrying out fixed maintenance of the sample on a stage mechanically as explained above The effect of a sample is [as opposed to / especially / the scanning photolithography machine which fixed maintenance is certainly carried out, therefore a stage moves at high speed] large even if the drift speed of a stage becomes large. Moreover, accuracy can improve a sample on a stage fixed maintenance, without being influenced by the wave of a sample, and unevenness. If vacuum absorption is carried out before maintenance performance's improving further and holding with press equipment, if vacuum absorption is used together, when it fixes with press equipment, a sample does not carry out a position gap.

[Translation done.]